

## DISCHARGE GAP DEVICE AND ITS MOUNTING STRUCTURE

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention relates to a discharge gap device in which discharge occurs between conductors, and more specifically to a discharge gap device which is provided between an antenna input terminal or a secondary side earth and a commercial power source, or between the power lines of a commercial power source as a ground discharge counter-measure for electrical equipments such as a television set, a video cassette recorder, and a television and video compound device, and to its mounting structure.

#### 2. Description of the Related Art

A CR (capacitor and resistor) compound part **21** whose circuit arrangement is as shown in FIG. 7 is known as a discharge gap device (for instance, B2R131C131, R1-2M121MF, etc. manufactured by Murata Manufacturing Co., Ltd.).

The CR compound part **21** comprises a discharge gap unit **22**, a resistor **23**, and a capacitor **24** which are connected in parallel to one another.

FIGS. 8(a) and 8(b) are external views of the CR compound part **21** shown in FIG. 7.

As shown in FIGS. 8(a) and 8(b), in the CR compound part **21**, lead wires **27** and **28**, which are to be inserted into a printed circuit board (not shown), are welded on a surface **29a** of a dielectric **29** with soldering patterns **25** and **26** which are conductors, and a resistor **23** is connected between the soldering patterns **25** and **26**. On a rear surface **29b** of the dielectric **29**, a silver (conductor) pattern **30** is printed or bonded, and the entire rear surface is covered with resin (not shown) so as to cover the silver pattern **30**.

With the discharge gap device thus designed, ends **25a** and **26a** of the soldering patterns **25** and **26** form the discharge gap unit **22**, while the dielectric **29** is held between the soldering patterns **25** and **26** and the silver pattern **30** to form the capacitor **24**. Thus, as shown in FIG. 7, a discharge circuit has been formed in which the discharge gap unit **22**, the resistor **23**, and the capacitor **24** are connected in parallel to one another.

FIG. 9 is a circuit diagram showing the discharge gap device (CR compound part **21**) applied to a television set.

As shown in FIG. 9, the current of a commercial power source **16** is applied to a rectifier circuit **17**, and the current rectified by the circuit **17** is supplied to a power source circuit (or switching power source circuit) **18**. The output current of the circuit **18** is supplied to a variety of load circuits.

A tuner **19** of the television set is connected through the discharge gap device **21** to the aforementioned commercial power source **16**. Normally, the discharge gap unit **22** is in non-conduction state; that is, the tuner **19** is insulated from the commercial power source **16**. A filter **20** is provided between the CR compound part **21** and the tuner **19**. The filter **20** is made up of a coil and the like to cut off high frequency components.

In FIG. 9, the one-dot chain line A indicates a primary power source side between the commercial power source **16** and the switch power source circuit **18**, and the other one-dot chain line B indicates a secondary power source side at the rear stage of the switching power source circuit **18**.

An earth (ground) **E1** forming the rectifier circuit **17**, and an earth **E2** which is connected through a capacitor C

between the rectifier circuit **17** and the switching power source circuit **18** mean the earth of the primary power source side A, and are at the same potential. Furthermore, an earth **E3** forming the switching power source circuit **18**, and earths **E4** and **E5** of the tuner **19** mean the earth of the secondary power source side B, and are at the same potential.

With the above-described circuit, when ground discharge occurs, the load circuits are prevented from damage as follows:

For instance, when the occurrence of ground discharge causes and high voltage is applied through the antenna (not shown) to the antenna input terminal **19a** of the tuner **19**, the gap of the discharge gap unit **22** of the CR compound part **1** connected to the tuner **19** is made conductive by the discharge, so that the high voltage is applied to the commercial power source **16**. The high voltage does not go to the side of the secondary power source B, whereby the load circuits are prevented from damage.

FIG. 10 is a circuit diagram showing the case where the two above-described conventional CR compound parts **21** are used.

In this discharge gap device, the two CR compound parts **21** and **21** are connected in series to each other, and one of the CR compound parts **21** is shunted by a capacitor C.

The two compound parts **21** and **21** are used mainly, for instance for a television set combined with a video cassette recorder, to meet the safety standard.

For instance, the UL (Underwriters laboratories) standard in U.S.A. is as follows: In the safety standard for a popular television set, it is necessary that the gap of the discharge gap unit **22** is at least 1.6 mm; and in the safety standard for a television set combined with a video cassette recorder, it is at least 3.2 mm because double insulation is required.

In the discharge gap device of the CR compound part **21**, the gap G (between the ends **25a** and **26a** of the soldering patterns **25** and **26**) of the discharge gap unit **22** is set to 2.6 mm. Therefore, in order to provide 3.2 mm, it is necessary to additionally manufacture a CR compound part. Hence, in order to meet the UL standard, two 1.6 mm-gap CR compound parts **21** are used to make the gap 3.2 mm.

Incidentally, in the above-described related art, the CR compound part **21** is employed as the discharge gap device. Hence, in the case where it is required to use a variety of resistances, it is necessary to newly manufacture CR compound parts.

Furthermore, the CR compound part **21** includes the capacitor **24**, and in the case of the ordinary connection, high frequency components pass through the CR compound part through the capacitor **24**, as a result of which high frequency components from the commercial power source is applied to the secondary circuit of the tuner **19**, or high frequency components from the secondary circuit of the tuner **19** are superposed on the power.

Hence, sometimes, it is necessary to connect the CR compound part **21** and a filter **20** to cut off the high frequency components.

Furthermore, in order to meet the safety standard of a television set combined with a video cassette recorder, the two CR compound parts **21** are employed; that is, the number of components is increased as much.

### SUMMARY OF THE INVENTION

In view of the foregoing, an object of the invention is to provide a discharge gap device and its mounting structure in which the resistance can be changed with ease, and the